

## CLAIM

1. A powered orthotic device for augmenting a person's muscular functionality comprising:  
a brace adapted to be coupled to a body part of the person and having a length such that the brace traverses a joint of the person, said brace including at least one strap for attaching the brace to the body part of the person;

sensing means, fixed in at least one of the at least one straps such that when said strap is coupled to the body part said sensing means is coupled to at least one muscle of the person and wherein in response to the person attempting to move the body part, said sensing means senses a surface electromyographic (EMG) signal of the muscles connected to the joint and determines a desired joint torque from the EMG signal and provides a sensor signal in response thereto; and

an actuator coupled to receive the sensor signal from said sensing means and in response to the sensor signal said external actuator provides a force having a magnitude which is proportional to a magnitude of the sensor signal provided by said sensing means and wherein the ratio of power delivered by said actuator to the mass of the actuator takes into account all of the elements needed to generate the force.

2. The device of Claim 1 further comprising:

means for receiving the sensor signal and for scaling the sensor signal by a variable amount; and

an active feedback control loop circuit coupled to control the amount of force applied to the joint by said external actuator.

3. The device of Claim 2 wherein said active feedback control loop circuit further comprises means for providing a measurement of output torque to ensure an accurate application of force.

4. The device of Claim 3 further comprising:

a cable drive coupled between said actuator and said brace such that in response to movement of the actuator, said cable drive moves the brace.

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2 5. The device of Claim 4 further comprising a wheelchair wherein:  
3 at least a portion of said cable drive system is coupled to said wheel chair; and  
4 said actuator is disposed such that the mass of said actuator is substantially supported by  
5 said wheelchair.

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7 6. The device of Claim 1 wherein said actuator corresponds to an electric actuator.

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9 7. The device of Claim 1 wherein said actuator corresponds to a hydraulic actuator which  
10 comprises a compressor and wherein the ratio of power delivered by said actuator to the mass  
11 upon which the actuator acts is selected to be above a predetermined threshold level..

12  
13 8. The device of Claim 1 wherein said actuator corresponds to a pneumatic actuator which  
14 comprises a compressor and wherein the ratio of power delivered by said actuator to the mass  
15 upon which the actuator acts is selected to be above a predetermined threshold level.

16  
17 9. A powered orthotic device for augmenting a person's muscular functionality comprising:  
18 a brace adapted to be coupled to a body part of the person and having a length such that  
19 the brace traverses a joint of the person;  
20 sensing means coupled to at least one muscle of the person wherein in response to the  
21 person attempting to move the body part, said sensing means noninvasively senses a desired  
22 muscular force of the person and provides a sensor signal in response thereto;  
23 an external actuator coupled to receive the sensor signal from said sensing means and in  
24 response to the sensor signal said external actuator provides a force having a magnitude which is  
25 proportional to a magnitude of the sensor signal provided by said sensing means wherein the  
26 ratio of power delivered by said actuator to the mass of the actuator takes into account all of the  
27 elements needed to generate the force;  
28 a control means coupled to said external actuator, said control means including means  
29 for making a low impedance measurement of output torque and for providing a feedback signal  
30 to said external actuator to ensure an accurate application of the force provided by said external

1 actuator.